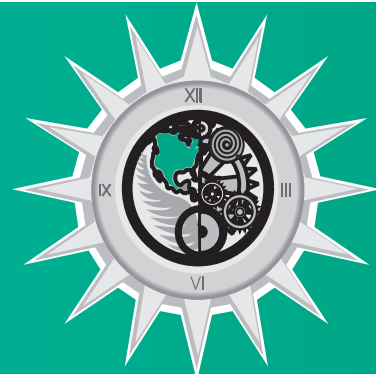


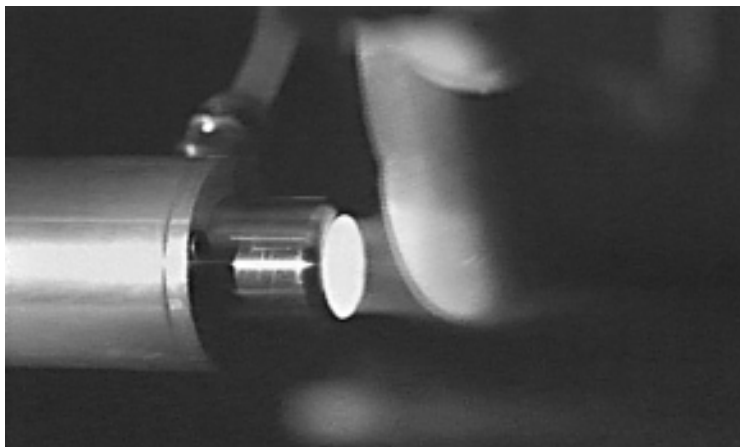
ESAVE

Environmental Stewardship & Value Engineering

Quarterly Newsletter for the United States Department of Energy,
National Nuclear Security Administration



Los Alamos has something hot in cool plasma jet technology



A plasma jet that operates in open air at temperatures as low as 50 deg C is opening new frontiers at Los Alamos National Laboratory.

Researchers at Los Alamos National Laboratory (LANL) have developed a new method for cleaning the surfaces of weapons components that may also find use in combating chemical and biological warfare agents, manufacturing printed wiring boards, and removing graffiti.

Los Alamos' atmospheric-pressure plasma jet (APPJ) is a non-thermal, atmospheric-pressure, glow-discharge plasma that can clean, decontaminate, etch, or coat surfaces at atmospheric pressure and low temperature. Operating at ordinary air pressure greatly expands the capabilities of plasma processing technology and helps prevent pollution.

For example, by spraying surfaces in the open air rather than in a vacuum, the plasma jet can convert a vast range of organic residues or toxins into water vapor, carbon dioxide, and other nontoxic gases, or it can volatilize actinide materials such as plutonium and uranium for collection by filtration. Under the plasma jet spray, reactive species de-excite and recombine to form ordinary molecular oxygen.

Operating at temperatures as low as 50 deg C, the APPJ can treat delicate surfaces without damage, or it can operate at up to 500 deg C to treat robust surfaces much more aggressively. And it's fast, cleaning large surface areas at about 1 square meter per minute.

Current APPJ research at Los Alamos is focused on the cleaning and detoxification of surface films on weapons components, destruction of surrogate chemical and biological warfare agents, and removal of actinide materials through etching. Los Alamos researchers are also exploring applications for the plasma jet ranging from microelectronics to building materials to textiles and health applications.

The new technology is delicate enough to remove photoresist from silicon wafers in microcircuit manufacture or to deposit thin silicon dioxide films for lining materials with glass. While it's robust enough to remove paint from brick, the atmospheric-pressure plasma jet can also sterilize surgical and dental equipment and surfaces in hospitals.

Contact Hans Herrmann, LANL, 505-665-6157 or herrmann@lanl.gov

INEEL helps visitors to National Parks get on the P2 bus

The U.S. Department of Energy's Idaho National Engineering and Environmental Laboratory (INEEL) is collaborating with Yellowstone and Grand Teton National Parks, automotive industry leaders, and other private industries to develop a low-floor, 18- to 32-passenger vehicle that uses alternative fuels and complies with the Americans with Disabilities Act. Management at Yellowstone and Grand Teton hope that such a vehicle will make their National Parks accessible to broader segments of the population while helping to alleviate one of their most serious environmental problems—automotive emissions.

In the first phase of the cooperative project, scheduled for completion early in 2003, program partners will develop a prototype of the shuttle bus with a natural gas power train. Eventually, the vehicle will be manufactured using several drive trains to allow for maximum flexibility in fuel use.

Contact Teri Ehresman, INEEL, 208-526-7785 or ehr@inel.gov



Idaho National Engineering and Environmental Laboratory is participating in the creation of a shuttle bus that uses fuels for the future while relying on classic design lines from the past. This artist's rendering of the bus illustrates how the design will help bring National Park visitors closer to nature while reducing emissions.

Livermore commits to LEED green building design principles

In October, Lawrence Livermore National Laboratory (LLNL) and the Department of Energy Oakland Operations Office (DOE/OAK) hosted an all-day workshop on the Leadership in Energy and Environmental Design (LEED™) Green Building Rating System, with a special executive session for lab managers and a project management class held on the following day.

Bruce Campbell of the LLNL Environmental Protection Department and Ian Watson of Plant Engineering produced and organized the workshop series. LLNL Plant Engineering Department Head Ed Helkenn and DOE/OAK sponsor Karin King welcomed facilities design and planning and project management participants from LLNL, Lawrence Berkeley National Laboratory, and Sandia National Laboratories to the workshop.

The workshop series was led by LEED instructor and U.S. Green Building Council and DOE consultant Bill Reed, who introduced participants to the LEED system and detailed the cost-effectiveness of green building methodology for designing and constructing buildings that are healthful, energy-efficient and environmentally friendly.

Reed presented examples of LEED-certified and -rated buildings, and demonstrated that there is no correlation between the level of LEED rating and relative first costs versus the costs of conventional design. "There have been buildings with LEED Gold or Platinum ratings (the two highest) with first costs at or near conventional building cost, while buildings rated Silver (a lower rating) have been built for as much as 15 percent over conventional cost." This implies, Reed noted, that first costs are more dependent on the quality and success of the design process rather than how "green" the building is constructed.

Reed pointed out that operating costs begin to dominate life-cycle costs for buildings within a few years of commissioning, a process which begins in the design phase and lasts at least one



Leadership in Energy and Environmental Design instructor Bill Reed addresses a workshop on green building design at Lawrence Livermore National Laboratory.

year after project closeout and is intended to ensure and document that all systems are operating as designed. Therefore, if an owner (such as the Federal Government in the case of DOE) is going to operate a building for more than three to five years, it is bad business to go for lower first costs in lieu of a functionally well-

designed, energy efficient building. Reed stated that he would not consider the design of an office/meeting space successful from an energy standpoint unless it was at least 30 to 40 percent more efficient than required by State of California energy efficiency standards for no added first costs.

According to Reed, "A building should be commissioned by an independent engineering company and should include training of maintenance and operations staff."

Reed emphasized the importance of adequate commissioning in successful, cost-effective green building projects. He cited statistics showing that on average, buildings not adequately commissioned perform 15 to 25 percent below design efficiencies.

The primary goal of this LLNL awareness program is to educate the lab's design community and management in green building principles, with the ultimate goal of incorporating LEED criteria into new buildings at LLNL and attaining LEED certification. DOE/OAK and LLNL plan to follow-up this event with a design charrette featuring a presentation to lab management by Dennis Aigner, Dean of the Donald Bren School of Environmental Science and Management at the University of California, Santa Barbara, whose new school is housed in a LEED-certified Platinum building.

Contact Bruce Campbell, 925-423-3481 or campbell15@llnl.gov and Karin King, 925-422-0756 or karin.king@oak.doe.gov



NETL fuel cell nixes idling big rigs

You see it all the time at rest stops and truckstops just off the interstate—18-wheelers parked in formation with their diesel engines idling to generate electricity for the lights, cab and sleeper while keeping the oil and the operator warm. It may be easy to commiserate with the driver, perhaps, but eight hours of all-night idling can consume a gallon of fuel per hour. At \$1.30 per gallon, it won't break the budget but it's hardly efficient—idling big rig engines consume 1.2 billion gallons each year. Researchers at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) are developing a bolt-on diesel-fueled solid oxide fuel cell concept that generates electricity and provides heat to keep the rig ready to roll, all at increased efficiency and with no pollution.

Contact Damon Benedict, NETL, 304-285-4913 or damon.benedict@netl.doe.gov

New cutting tools save on tritium waste disposal at SRS

Workers in the National Nuclear Security Administration tritium processing facilities at the Savannah River Site (SRS) needed to remove large amounts of process piping contaminated by tritium. Two different technologies were identified, one to cut small and one to cut very large diameter piping. Each new cutting system met the project's performance requirements for eliminating the metal fines that result from sawing and the heat generated from torch cutting, traditional methods which would have required that work to be completed in radiological control containments and tritium-protective suits.

EM-50's Innovative Technologies Program identified the blade plunging cutter, a method which was used to sever and size-reduce about 3,000 linear feet of 2-inch diameter stainless steel piping with welded joints. The blade plunging cutter increased work rates and eliminated approximately 700 cubic feet of low-level radioactive waste.

A split-frame clamshell cutter was used to cut and size-reduce over 720 linear feet of 42-inch diameter stainless steel pipe with welded joints. Jack Alexander, SRS tritium engineer, said, "The clamshell cutter helped greatly with size-reducing issues related to contamination control, and saved approximately 810 cubic feet of low-activity waste."

These two cutting technologies accelerated the project schedule and eliminated the need for over 400 tritium-protective

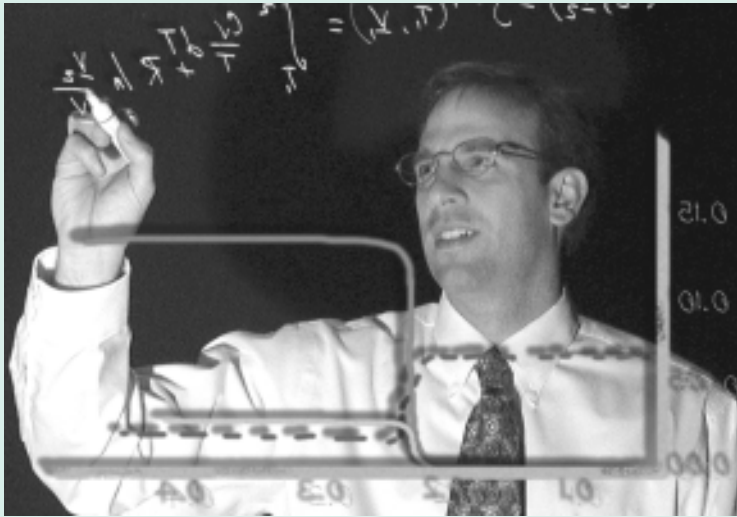


This clamshell cutter was used to cut stainless steel pipe from tritium processing facilities at the Savannah River Site.

suits, numerous glove bags, and other radiological control containments. After the tritium-contaminated piping was processed, both cutting systems were relocated to the SRS Decontamination Center to be reused by other Site organizations.

Contact John Harley, SRS, 803-557-6332 or john.harley@srs.gov

'Reciprocating compression reformer' converts dirty fuel



National Energy Technology Laboratory Researcher David Lyons describes speciation in the compression reformer concept.

A concept for a "reciprocating compression reformer" capable of converting a variety of fuels into formulas suitable for fuel cell operation has been developed by the Fuel Processing Team at the U.S. Department of Energy's National Energy Technology Laboratory (NETL). The affected fuels include pipeline natural gas and transportation-quality liquid fuels.

Theoretically, the process could utilize contaminated fuels to synthesize a gas of concentrated H_2 and some CO . The invention offers favorable economics and portability since it does not require external heat transfer and eliminates several unit operations required in conventional fuel processing technologies. NETL is working with Pennsylvania State University to develop a mechanical design analysis of the concept.

Contact Damon Benedict, NETL, 304-285-4913 or damon.benedict@netl.doe.gov

Sandia, Boeing Company establish cooperative technology partnership

The U.S. Department of Energy's Sandia National Laboratories (SNL) and the Boeing Company signed an umbrella Cooperative Research and Development Agreement Sept. 5 to develop technologies that mutually benefit both.

"From the Boeing side, sharing technology with Sandia will help each of us bring new or improved products to market faster and employ new manufacturing processes that reduce cycle time and cost while improving the quality and performance of our products and services," said Dick Paul, a Boeing vice-president.

Headed up at Sandia by researcher Craig Tyner, who is working in conjunction with Boeing project engineers Mike McDowell and Bob Litwin, the initial tasks will deal with concentrating solar power technology. This will include a broad range of technologies, including power towers, dish engine systems, solar troughs and concentrated photovoltaics. The project will focus on the development of key demonstrations, risk-reduction testing and economic/system analyses.

Contact Chris Burroughs, SNL, 505-844-0948 or coburro@sandia.gov

Boiling or chilling, water treatment savvy keeps costs at bay



Operator Paul Ganz monitors displays in the boiler house control room at Argonne National Laboratory-East, where efficient levels of chemicals in the boiler water are maintained through strict statistical process control.

In 1996, chemical costs for boilers, chillers, and cooling towers water treatment at Argonne National Laboratory-East (ANL-E) were a hefty \$450,000—the projected 2002 price tag is a much more palatable \$273,000. How did \$177,000 get trimmed from the Argonne heating and cooling bill? As Jim Heine of Argonne's Plant Facility Services (PFS) explains it, continuous improvement in operations and a hard-working partnership with Ondo Nalco of Naperville, Ill., delivered for the lab's budget.

Ondo Nalco provides the chemicals ANL-E uses for water treatment and performs Argonne's water analyses. Since 1991, PFS and Ondo Nalco have held quarterly business reviews, during which the vendor presents updates on previously identi-

fied opportunities, performance issues, and cost avoidance measures and listens to what ANL-E has to say about its needs. Ondo Nalco business managers have come from such far-flung places as South America and Austria to observe this productive way of doing business.

During a review held in July, PFS and Ondo Nalco identified significant cost avoidances at the Argonne steam plant that are the results of continuous improvement under the business review method. From Ondo Nalco's side, newly developed chemicals have been substituted for older ones to do the work better for less cost. On the ANL-E side, statistical process control makes the chemicals go further. Add in a staff of vigilant operators, and chemical use in the steam plant is kept at highly efficient levels. The steam plant is not the only facility to reap the benefits of continuous improvement. Timers on feed pumps in the site's chillers and cooling towers dispense chemicals effectively, and use of all chemicals has been carefully scrutinized to avoid cost increases.

Another significant factor identified at the July meeting that combines improvement with cost avoidance is the absence of scale in the lab's boilers, chillers, and cooling towers. Scale is the enemy on any surface that transfers heat, and treating the water keeps the scale down, helping essential systems work at their peak efficiency.

According to Heine, 10 years ago the lab's boilers were severely scaled. Heine estimates an annual cost avoidance of \$125,000 and an additional annual savings of \$290,000 in electrical costs. It all adds up to a very significant payoff for a proven partnership in continuous improvement.

Contact Keith Trychta, ANL-E, 630-252-1476 or ktrychta@anl.gov

DOE weatherization program celebrates its 26th anniversary

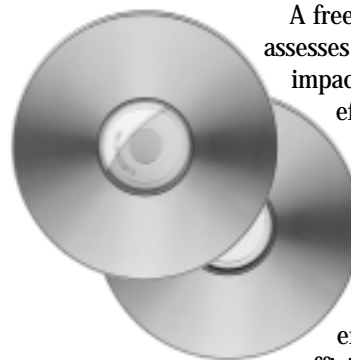
The U.S. Department of Energy's (DOE) Weatherization Assistance Program, which helps reduce the energy bills for low-income households, celebrated its 26th birthday on Oct. 30. The program has provided energy efficiency improvements to 5 million U.S. homes, saving each household an average of \$218 in energy bills annually.

The program provides congressionally appropriated funds to state weatherization offices, which provide grants to local agencies to perform the work. These services are available in every county in the nation. For every dollar provided by the DOE program, an addition three dollars come from other sources such as state funds, utility programs, and Federal Low-Income Home Energy Assistance Program grants from the U.S. Department of Health and Human Services.

In some states, a home weatherization team might provide other services such as repairing unsafe electrical wiring or installing a new refrigerator.

Go to http://www.eren.doe.gov/buildings/weatherization_assistance/

New software evaluates renewable energy and efficiency projects



A free, spreadsheet-like software that assesses the environmental and financial impacts of renewable energy and energy efficiency projects has been released by the U.S. Department of Energy's Lawrence Berkeley National Laboratory (LBNL).

The Berkeley Lab-introduced ProForm can assess wind turbine installations, residential lighting efficiency programs, and energy efficiency improvements in commercial buildings. The software calculates emissions of CO₂ and several local air pollutants that may be avoided as a result of a project. It allows the user to construct a baseline that can reflect changes in emissions impacts expected over the lifetime of the project and provides a financial assessment from the perspective of the sponsor of the project.

Contact Bill Golove, LBNL, 510-486-5229 or go to <http://eetd.lbl.gov/proform>

Arizona workshop finds brighter tomorrow despite clouds of doubt

Even Sonoran Desert weather in the bygone citrus groves of Phoenix couldn't dispel the foreboding at the National Nuclear Security Administration's (NNSA) 20th pollution prevention workshop in November. In the low humidity, cloudless skies, and warm temperatures typical of late autumn in the Valley of the Sun, NNSA, Department of Energy (DOE), and contractor employees harvested valuable knowledge to bring back to their workplaces. But apprehension about the future of these workshops and concern over DOE pollution prevention in general cast a pall over the normally sanguine gathering.

Beverly Cook, DOE's Assistant Secretary for Environment, Safety and Health (EH), opened the workshop's plenary session via a video appeal to participants. "For your part, you need to sell P2" at sites and within organizations. "For my part, I'll be the champion for pollution prevention" at the secretarial level, Cook promised. In attendance, Jane Powers, who works with Cook at DOE Headquarters, asked participants to let her know "if something changes for the good" as a result of Cook's Nov. 15 memorandum to DOE program secretarial officers in support of adequate funding for pollution prevention.



John Marchetti challenges attendees to "walk through the brambles"

(current budget) cuts are good. One of the reasons we lost our momentum, we took the easy way out," such as promoting only recycling and affirmative procurement. "Any time there's change, there's opportunity . . . Everything's brand new—Attack!"

If that didn't get workshop participants moving, Joe Estey of Prolepsis Training primed their pumps in his inimitable style, beginning with a card exercise to demonstrate how to "launch the legacy" of successful pollution prevention. Estey's amazing demonstration was followed by Rich Polito, head of the Maricopa County, Ariz. Small Business Environmental Assistance Program (SBEAP), which helps local businesses incorporate pollution



Workshop facilitator Joe Estey

prevention into their operations and offers students the opportunity to move toward careers in environmental management as part of the organization Arizona Environmental Leadership through Mentoring. (Go to <http://www.maricopa.gov/sbeap/sbeap.htm> and <http://www.azelm.org>)

Speaker Dennis Hjeresen of Los Alamos National Laboratory is currently working with the American Chemical Society (ACS) Green Chemistry Initiative. Hjeresen had some disturbing budget numbers to share with the workshop. In FY 2003, pollution prevention funding in DOE and NNSA has been "zeroed out" completely. This runs counter to trends in both private industry and other government agencies, where high returns on P2 investment are the norm. Since 1996, for example, the Department of Defense (DOD) has reduced its total



Dennis Hjeresen of Los Alamos National Laboratory explains the counter trend in DOE P2 funding.

environmental budget by nearly \$75 billion through pollution prevention efforts, which by FY2001 made up 21 percent of DOD environmental compliance spending. On the other hand, Hjeresen pointed out, DOE funding for P2 has declined despite documented returns on investment, from a high of \$33.5 million in 1995, which even then represented only 0.05 percent of DOE's environmental spending. DOE's proposed environmental management budget of \$7.3 billion for FY2003 provides no funds for pollution prevention.

On a hopeful note, Hjeresen told the workshop session, the ACS has developed a position statement on P2 efforts at DOE, and recently sent an official message to Congress and the Secretary of Energy recommending that DOE "make a meaningful investment in pollution prevention." This was news to EH's Powers and NNSA's Dick Crowe, who had several questions for Hjeresen about the ACS initiative.

Facilitator Estey took center stage again, leading the topic area groups in exercises tailored toward improving P2 strategy and implementation. NNSA's Crowe (NA-53) then made a presentation on integrating environmental management systems (EMS) into integrated safety management (ISM). Crowe reminded participants of the ISM DEAR clause, 48 CFR 970.5223-1 (formerly 970.5204-2), which defines safety as encompassing environment, safety, and health, including pollution prevention and waste minimization. A DOE contractor's safety management system is a contractually binding document that should include a description of the EMS. He cited a review by management at Lawrence Livermore National Laboratory demonstrating that ISM and EMS were in fact already well integrated at that facility.

See 'Arizona Workshop finds' page 6



Dick Crowe (NA-53) addresses ISM and EMS issues.

"I need to work on getting more DOE people to these workshops," Crowe added. "You need DOE support and DOE acknowledgement of these issues."

In the afternoon plenary session, Li-Yang Chang of Lawrence Berkeley National Laboratory (LBNL) addressed the assembly on LBNL's success in treating tritiated mixed waste (see page 14). Hjeresen came back to talk about NNSA's potential for developing sustainable technologies in a collaboration with the ACS Green Chemistry Institute. Green chemistry is reducing or eliminating the uses or generation of hazardous substances in the design, manufacture, and application of chemical products. Hjeresen outlined common-sense economic reasons for "doing" green chemistry, such as the rising price of the number one feedstock, natural gas. He also noted that there are national security issues, such as eliminating chemical targets of terrorism. Hjeresen described one NNSA/industry collaborative success in developing photoresist removal by CO₂ cleaning (see SCORR article, right).

Prolepsis Training's Estey returned to facilitate brief breakout sessions where the five working groups identified issues that are barriers to successful pollution prevention programs at their sites and brainstormed solutions for these issues. A spokesperson for each group then briefed the workshop gathering on the identified issues and suggested solutions. Marchetti was inspired by one presentation to talk about the many successes fostered by dedicated leadership at the Kansas City Plant in integrating P2 into operations there.

On the workshop's second day, the working groups traveled to various Phoenix-area industries and public-owned facilities to discern how the local hosts achieved their pollution prevention successes. (See articles on the group visits on pp. 7-12.) On the third and final day of the workshop, the topic area groups made presentations to the workshop assembly on the their site visits.



Bill Schlosberg of the Kansas City Plant presents John with a 'Pig Award.'

John Marchetti's closing remarks were interrupted by a tribute to his years of service to DOE, NNSA, and his nation, followed by spontaneous testimonials from several of his long-time colleagues and the presentation of some surprise gifts. An emotional Marchetti thanked participants and reminisced about some of his experiences as NNSA's primary P2 advocate. Back to business, he urged DOE/EH to re-start the inter-office Waste Reduction Steering Committee. He reminded attendees to get busy on DOE Project Funding Requests and to use the Office of Science's EPIC on-line pollution prevention clearing-house. He used examples from his many years of coaching football to demonstrate his final point. "If you don't have persistence in life,

you have nothing," Marchetti told the workshop. "If you don't give yourself a chance, you'll have nothing. Don't let other people define you."

Contact Elizabeth McPherson, McPherson Environmental Resources, Inc., 423-543-5422 or mer@mer-inc.com and go to <http://epic.er.doe.gov/epic/>

LANL makes a big SCORR



SCORR is a finalist for the 2002 Tech Museum Awards.

Supercritical Carbon Dioxide Resist Removal (SCORR) uses carbon dioxide in its supercritical form, heated and pressurized until it becomes a zero-surface tension fluid. In this form, the supercritical CO₂ can be used to remove the waste produced during photolithography.

Photolithography is the process involved in creating tiny circuits in a computer chip—think of it as altering the topography of a silicon wafer.

Solvents are typically used to do this, with ultra-pure water needed afterward to clean up the solvents. SCORR carries out both functions and produces virtually no hazardous waste.

The Los Alamos National Laboratory technology has the potential to rapidly advance integrated circuit technology and make a significant positive impact on the environment. Indeed, SCORR technology may one day change the very way integrated circuits are manufactured.

In recognition of this potential, SCORR was selected as a finalist for the 2002 Tech Museum Awards. These are given by the Tech Museum of Innovation in San Jose, Calif., in cooperation with the American Council for the United Nations University and Santa Clara University's Center for Science, Technology and Society.

"We were surprised to learn that we'd even been nominated, much less selected as a finalist," said Craig Taylor of the Laboratory's Applied Chemical Technology group. "The entire SCORR team is excited and honored to be representing the Laboratory and the SCORR technology in this competition."

The SCORR team includes Taylor, Leisa Davenhall, Kirk Hollis and Jerry Barton of LANL's Applied Chemical Technology group and Jim Rubin of Nuclear Materials Technology division.

Tech Museum President Peter Giles said, "These innovators will help us achieve our goal of inspiring future scientists, technologists, and dreamers to harness the tremendous power and promise of technology to solve the global challenges that confront us today."

The Tech Museum awards are designed to honor individuals, for-profit companies and public and not-for-profit organizations from around the world who are applying technology to profoundly improve the human condition in the categories of education, equality, environment, health and economic development.

Contact Kevin Roark, LANL, 505-665-0582 or knroark@lanl.gov and go to <http://www.techawards.thetech.org>

Unlikely looking car shop shares secrets of common-sense P2 success



Salem Boys Auto in Tempe has a clean and classy "architected" look.

It may not look like an automotive repair shop, but it is. And Salem Boys Auto owner Mark Salem may not seem like an environmental type, but he can't help it—it's just plain common sense, and he's got plenty of that.

A team from the November NNSA workshop visited Salem Boys to find out how the highly successful Tempe repair shop makes money out of making sense. Like most sustainable business success stories, this one begins at the end of another era.

In the late 1970s, Salem Boys was based in a Mobil gas station, where a leaking underground storage tank caused an environmental mini-disaster that made owner Salem ponder his legacy—he didn't want to leave property that had been devalued by pollution to his children and grandchildren.

A third-generation Arizona rancher and businessman, Salem knows something about property values. In the design phase for the current building, he lay awake at night thinking of ways to protect the new property and to ensure that even the building itself would be there for future generations.

Therefore, to Salem a multipurpose building made sense. The shop portion of the building is designed to be quickly and easily converted to other uses—the central wall dividing the repair bays is precisely the height to anchor the mezzanine of a warehouse's modular storage racks. He envisioned lower cooling bills, a major expense in the Arizona climate. So Salem specified Graylight 14™ bullet-proof windows with 70 percent heat rejection and 100 percent UV rejection, which are either north-facing or recessed. He went "super deep on the insulation." Air conditioners for the two-story office portion of the building are sheltered from the desert sun in a specially built third floor.

Salem designed and had custom-built a 44,000 CFM cooler for the shop that changes out the inside air once every two minutes. He had to stop the mechanics from lifting the 14-by-20-foot shop doors just enough that the blower would sweep for them, because he didn't want the debris going into the parking lot. The shop doors are oriented east-west, so that prevailing west winds cool the area most of the year; the shop can be maintained at 82 deg F in a hot (over 100 deg F) Tempe summer.

He installed four lighting banks in the shop, but by daylighting through the always-open shop doors, only the two interior bays are ever illuminated. For a 12,500 square-foot shop, electric power usage is quite low.

The in-ground hydraulic lifts used to raise vehicles to work height proved to be a liability in financing construction of the Salem Boys shop, because they work on a large volume of oil under pressure, and spills are inevitable. So for his double-wall, single-post lifts Salem specified vegetable oil—it saved money on insurance, too.

Even if there is a spill, the shop floor drains empty into a series of catch basins for sludge and hydrocarbon removal, emptied every week, another of Salem's innovations. The roof water and storm runoff from the parking lot also drain into this system, so clean water is all that drains into the two 150-foot dry wells at each corner of the 2.5-acre property, per local regulation. The dry wells contain huge, white, fiberglass pillow filters that in nine years have yet to need cleaning, while the neighbors' get cleaned at least yearly at upwards of \$500 per well.

"We treat our auto repair facility like a bakery—some people say you can eat off the floor," Salem said. "It's just a matter of common sense. You don't need to understand lots of technical data, you just have to know such things as that oil floats and can be separated from water."

Common sense prevails in shop operations, too. All Salem Boys' fluids are bought in bulk and dispensed at the workstation. Refrigerants (both R12 and R134) are reclaimed and reused; reclaimed coolant (antifreeze) is distilled and mixed 50/50 with new. Salem redesigned the coolant recycler to include a 5-micron sock filter and a settling tank, and boosted the tank filter from 70 microns to 120 microns. The hazardous waste stream for the entire shop is one 55-gallon drum of "bad stuff" that costs about \$500 per year to have incinerated.



Mark Salem shows an ultrasonically cleaned fuel injector to Lawrence Livermore's Thom Kato, left, and Dennis Murphy from the Savannah River Site.

There are two aqueous parts washers and an ultrasonic fuel injector cleaner. (FACT: Get your injectors *removed* to be cleaned!) Yet the shop still uses small quantities of commercial solvents, principally brake cleaner. According to Salem, the largest-volume waste stream is the water from the sink where parts and hands get rinsed, which runs to the catch basin system.

Everything gets recycled—the customer gets back her car parts, unless she doesn't want them, in which case a high school kid comes by and picks them up to sell for scrap. Aluminum gets sold. See 'Unlikely looking car' page 11

Alternative energy generation a focus for the Salt River Project



The Salt River Project's Arizona Falls Hydroelectricity Project will use low-impact hydroelectric generation technology to generate 750 kilowatts.

The NNSA workshop Renewable Energy team toured three sites that are part of the Salt River Project (SRP) in Phoenix, Arizona: the Arizona Falls Hydroelectricity Project, Tri-Cities Landfill Gas Generating Station, and the Thermal Hybrid Electric solar dish (THE SunDish). The Salt River Project is a Federal reclamation project responsible for electricity generation and water management of 240,000 acres in the Phoenix area. SRP, the nation's third largest public power provider, has committed \$29 million over four years to invest in renewable energy resources without raising electricity prices to its customers. Renewable energy projects underway include a variety of technologies—low-impact hydroelectricity, solar water heating, solar thermal dishes, photovoltaics, and wind. Wood chips and digester gas as renewable sources are currently being evaluated for possible inclusion in the program.

The Renewable Energy team's host for the day was Lori Singleton, Manager of Environmental Initiatives for SRP, and site hosts Jim Duncan at the hydroelectricity project and Mike McCleve at the landfill. The hosts provided the NNSA visitors with an overview and history of the SRP, traditional water and energy costs in the City as well as the broader region, and details on the alternative energy projects.

The Arizona Falls Hydroelectricity Project is located at the historic waterfall in the Arizona Canal created by a natural 20-foot drop in elevation. Electricity was generated at Arizona Falls as early as 1902. At this site, a hydro-turbine will be used to capture and use the power of the falls, a process referred to as low-impact hydroelectric generation. Water travels through a channel separate from the canal and the falling water is used to turn the wheels of the generators. The facility is expected to produce 750 kilowatts, enough to power approximately 150 homes each year. Solar panels will be installed on the Arizona Falls' turbine building and shade structures to generate additional clean energy.

In addition to generating clean energy, this project is part of Phoenix's canal beautification efforts. The landscaping around the Arizona Falls project is designed to use art and landscape architecture to reconnect the public with the canals. Native landscaping techniques are part of the design, which also

includes an environmental education center at the site that will focus on renewable energy.

The Tri-Cities Landfill Gas Generation Station is located in the Salt River Pima-Maricopa Indian Community (SRPMIC). Decomposition in landfills generates methane and other gases. In the Tri-Cities Landfill gas generation system, these gases are captured using wells and are used to fuel five internal combustion engines generating four megawatts, enough to power 2,000 homes each year. This project is the first landfill gas-to-energy project on an Indian reservation, thanks to a successful partnership between SRP, SRPMIC, and DTE Biomass Energy. This partnership is based on the Indian Community's desire to responsibly manage landfill methane collection, SRP's search for renewable energy projects, and DTE Biomass Energy's interest in expanding its market in the Phoenix area.



The Renewable Energy team in front of THE SunDish. From left to right: David Janke, Heather Merrill, Annette Andrade, Kim Fowler, Jane Powers, Marjorie Gonzalez, Lori Singleton, Li-Yang Chang, and Cynthia Zvonar.

THE SunDish, a pilot project that uses both solar energy and landfill gas to generate electricity, is also located in the Salt River Pima-Maricopa Indian Community. This novel device focuses Arizona's abundant sunlight to heat landfill gas circulating in tubes that in turn powers turbines for electric power generation. This project had many partners, including the U.S. Department of Energy and several of its national laboratories. THE SunDish is located near the new SRPMIC recycling center and generates 22 kilowatts of electrical energy when in operation. At the time of the NNSA Renewable Energy team visit, THE SunDish was not in operation because the engine was being replaced.

The Salt River Project is now marketing alternative energy to its customers as "EarthWise Energy," which they define as locally produced, clean energy. They are offering 100-kilowatt hour per month blocks of EarthWise Energy to their customers at a premium of \$3 per month per block—more than 2,500 SRP customers are currently requesting EarthWise Energy.

Contact Lori Singleton, Salt River Project, 602-236-3323 or lasingle@srpnet.com and Annette Andrade, Lawrence Livermore National Laboratory, 925-423-0706 or andrade2@llnl.gov

PING Golf scores double eagle with ISO 9001/14001 certifications



EMS Group visits PING Golf. From left to right: Janell Hales, Rachel Watkins, Jimmy Starling, Sally Starling, Raj Sharma, David Rosier, Bill Schlosberg, John Marchetti, Jim Helt, and Al Villareal.

Eleven attendees of the NNSA workshop recently toured PING¹ headquarters in Phoenix, Arizona. Hosted by Director of Environmental Systems, Rob Barnett, this Environmental Management Systems (EMS) Topic Group observed ways in which implementing both ISO 14001 and 9001-2000 allowed PING to continue its commitment to environmental stewardship while enhancing optimum production and quality control.

PING manufactures custom fitted golf clubs, golf bags and golf accessories. Started by Karsten Solheim in his home garage in Redwood City, California, the manufacture of PING golf equipment in Phoenix, AZ has grown in the past 44 years from one small building to 28 buildings spread over 38 acres with a work force of approximately 800 in the United States.

Beginning with a "top-down" effort from Chairman and CEO John A. Solheim and President/COO Doug Hawken, PING received both ISO 9001 and ISO 14001 certifications in October 2000. Barnett says "it only made sense" to accomplish both at the same time, since the mechanism to achieve 9001 certification was so similar to the discipline required for 14001.

PING accomplished the dual feat in only 13 months, making it one of only 11 companies in the entire state of Arizona and the first golf club manufacturer in the United States to have both certifications. The plant in Empalme, Mexico where PING's golf bags are manufactured, is ISO 9001-and 14001-certified. Also, PING Europe Ltd. assembly plant and golf club in Gainsborough, England are ISO 9001/14001-certified. The Gainsborough Golf Club is believed to be the world's only ISO 9001/14001-certified golfclub and course.

PING saw the certification process as desirable because:

- ISO 9001 and 14001 are internationally recognized standards and certification would bring value to PING through the way it is perceived in the business world.
- PING wanted the benefits of improved quality control with environmental awareness provided by the certification process.
- The standards emphasize customer satisfaction, continuous improvement and environmental stewardship.

While formulating the EMS necessary for certification, a number of practical and cost saving improvements were discov-

ered or strengthened. Just a few of the many examples include:

- The use of a recycling system allowing reuse of the solvent in the shaft gripping process.
- Club head grinding stations are equipped with a particulate exhaust system and central collector—the accumulated metal is then recycled.
- A reduction in the volume of solvent-containing rags was achieved six-fold by using a compaction unit to increase the weight of material per drum.
- Total air emissions were significantly decreased by process changes despite an increase in golf club production.
- The installation of an inline filtration system for air compressor blowdown fluids eliminated handling and processing steps and costs savings paid for the units in one year.
- Regulatory agencies, inspectors and auditors are a valuable part of PING's ISO 14000 process.

Besides assured regulatory compliance systems and disposal cost savings, the certification process provided many ways to be more efficient throughout the production process. The management systems allow custom club orders to be filled in 48 hours, vastly improving customer satisfaction.

Consistent with the concept of an effective EMS and guidelines of ISO 14001/9001 for continuous improvement:

- PING maintains an intranet site for work procedures and instructions, forms, objectives, targets, and employee communication. Employees are also encouraged to practice environmentally sound practices in their homes with links to pertinent references for the Phoenix area through <http://www.Earth911.org>.
- ISO corrective action and suggestion boxes are located at all entrances to the PING facility.
- PING is in the process of consolidating several of its club assembly lines into a single "lean" manufacturing area, which will reduce waste and energy consumption while increasing productivity. This new arrangement will also decrease the manual deployment of production chemicals by allowing a central containment and pumping area.
- PING is researching and testing to find more environmentally friendly materials, certifying certain vendors for quality control and environmental compliance and continually enhancing the already impressive employee training and awareness programs.

John Solheim perhaps sums up the ISO-certification process the best: "No one asked us to become ISO-certified. We raised our standards because golfers ultimately decide the fate of our products. Customer satisfaction will be the program's greatest benefit. I think my father would say, 'Well done. I'm proud.'"

¹ PING is a registered trademark of Karsten Manufacturing Corporation



Contact Rob Barnett, PING, Inc, 602-687-5255 or robb@karsten.com and Bill Schlosberg, Honeywell FM&T, 816-997-3673 or wschlosberg@kcp.com

Workshop group digs up sustainable construction tips in the desert



Arizona Army National Guard's Eco-Building

The NNSA workshop's Sustainable Construction group's first visit was to the innovative Arizona Army National Guard "Eco-Building," hosted by T.J. Roe, the Eco-Building project manager.

The main goal was to make this recently completed 5,200 square-foot building, self-sustaining in electrical power, heating and cooling, and sanitary sewer. Supporting this goal, the building was to be constructed with recovered materials and to be as energy efficient as possible.

An 11 kW photovoltaic (PV) system with both tracking and fixed panels and four 400W wind turbines provide the Eco-Building with 12.2 kW of electrical power. Only the building's 5-ton air-to-air heat pump is powered from the local utility; a planned 20 kW expansion of the PV array will allow the heat pump to be powered from the site system.

The heat pump system provides ventilation to the office building, usually in cooling mode when cooling from the thermal-mass walls is inadequate. The HVAC distribution ductwork is located within 5-foot diameter concrete piping eight feet below the floor, minimizing heat gain. Heating is never required because of internal heat gain from people, computers, printers, lighting, and the passive-solar design of the double-pane windows, which were recovered from a building scheduled for demolition.

Eco-Building's thermal mass walls consist of 4,500 worn-out tires packed with dirt and weighing 300 pounds each, stacked like bricks. Spaces between the tires are filled with aluminum cans. The tire wall also "leans" slightly to the outside to support the massive earth berm packed against it. That's approximately 675 tons of thermal mass, which stores heat in winter and absorbs heat in summer.

The main sources of interior area lighting are the double pane windows, six solar tracking skylights, and solar tubes. All other auxiliary lighting has either fluorescent or LED lamps.

The metal roof "harvests" rainfall and funnels it to four cisterns, each with a capacity of 10,000 gallons. Based on the average rainfall in Phoenix, the 4,800 square-foot roof will harvest 28,000 gallons of water per year—enough for Eco-Building users throughout the year. The on-site electrical system powers the pumps that pressurize the water system.

The wooden truss roof system is insulated internally with cellulose and a metal-impregnated film that acts as a radiant barrier.

Because it relied on construction materials such as tires, aluminum cans, dirt, and reused windows and office partitions, Eco-Building construction was cost-efficient. Inmates from the Maricopa County Sheriff's office constructed the thermal mass walls. As a result, cost of this structure was about half that of a standard office building of the same size. Eco-Building received the 2000 Governor's Pride in Arizona Environmental Leadership Award and a 2001 EPA Region 9 Environmental Achievement Award. It was recognized by the Federal Energy Management Program as a 2002 Federal Energy Saver Showcase and by EPA Region 9 as a *Champion of Green Government*.

Contact T.J. Roe, Arizona Army National Guard, 602-267-2663 or tj.roe@az.ngb.army.mil and Jack Mizner, Sandia National Laboratories, 505-845-3576 or jmizne@sandia.gov and go to <http://www.azecobuilding.com/>



The Sustainable Construction team next to the Desert House. From left to right: Chris Houston, Mike Hess, Tom McGeachen, Barbara DeRoos, Jack Mizner, Thom Hulen, Jessica Moseley, Karin King, and Beth McPherson.

The Desert House—'Home of the Present'

The workshop's Sustainable Construction group also toured the Desert House at Maricopa County's Desert Botanical Gardens. Using readily available materials and proven building techniques, the Desert House partners have clearly demonstrated that a house inhabited by a typical family can be operated comfortably and economically while saving as much as 50 percent in energy and water costs.

Demonstrating ways to save energy without sacrificing quality of life is crucial to the mission of the Desert House project. This 1,650-square foot, 3-bedroom home was built in 1992 for a cost of \$120,000 and has been occupied since construction. The occupants live rent-free, paying only their utility bills. All interior lighting uses compact fluorescent bulbs and the house was outfitted with mid-priced electrical appliances with water- and energy-saving features.

The Desert House uses ancient regional techniques—south-facing windows and doors, thick walls for thermal mass—joined with modern technology and materials. Passive solar heating and cooling strategies, practically maintenance-free, mean that

temperature extremes do not occur in interior spaces. Forty-five percent of the electrical energy used in a typical Phoenix home goes for heating and cooling with a heat pump; the Desert House heat pump accounts for only 19 percent of the occupants' total annual electric power use.

Desert House windows are built on the south wall, where they collect as much heat as possible during the winter. In the summer, windows are shaded from the sun by a parapet wall, awnings, trees, and a patio cover to reduce direct solar heating of the interior. The east and north walls have only two windows each and the west wall has only one, which is blocked from direct sunlight by a wall. Most of the windows are set 16 inches into the wall for shading. A clerestory window can be opened to allow rising warm air to exit the house.



Ancient building techniques combined with modern materials and technology make the Desert House a highly energy efficient abode.

Trees placed near the house provide shade and minimize heat gain during the summer. Deciduous trees and vines placed in front of the south-facing windows allow the sun's heat to enter the house during the winter when there are no leaves, but shade the windows from direct solar exposure during the summer. A garage on the west end of the house provides a buffer against the sun's heat.

An insulated, 6-inch thick concrete floor and an Integra™ concrete block wall system create thermal mass to absorb and release heat in the cool evenings and winter. Wall-to-wall carpet and vinyl floor coverings are not used because the insulation provided by these products limits the effectiveness of the concrete floor's thermal mass.

Interior perimeter walls are framed with 2x4 lumber and exterior walls with 2x6 lumber; each wall side is covered with drywall. All interior walls are treated with gypsum-based texture and painted, a common interior finish in the Phoenix area. Exterior walls have a Portland cement scratch coat covered with an elastomeric stucco composed of acrylic polymers that will shrink and expand in response to outside temperatures and will not crack, maintaining an impermeable seal. Total R-value for the exterior walls is 30.

The Desert House roof was engineered to provide maximum protection from moisture and heat gain as well to maximize the collection of rainwater. From top to bottom, the roof consists of a white reflective coating, a layer of aggregate, polyurethane water sealers, insulating foam, contouring foam, a plywood deck,

12 inches of fiberglass insulation, and another plywood deck. The R-value of the roof is 40. The roof shape directs rainwater to flow to downspouts at the corners.

Roof water flows from the downspouts through a sand filter to a 4,700-gallon cistern in the basement. When necessary, the stored rainwater is pumped to the surface for landscape irrigation. Average annual precipitation for the Phoenix area is around 7.5 inches; the Desert House's 2,209-square foot roof can amass 9,277 gallons per year. If the cistern is full, the downspouts can be adjusted to divert water directly onto the landscape.

The Desert House landscape needs approximately 104,860 gallons of water per year, so roof water can account for only about 9 percent of that. Graywater from the showers, bathtubs, bathroom sinks, and washing machine is diverted to two 4,700-gallon storage tanks also located in the basement, and can account for another 11,370 gallons, or 11 percent of total irrigation demand. Combined, the rainwater and graywater harvest can save 20,647 gallons of water per year that would have normally come from the city water supply.

Rainfall that lands on the landscape is diverted to plants via contoured slopes and berms. Plants needing relatively more water are placed to collect more runoff. Basins built around particular plants collect water and allow it to percolate slowly through the soil, insuring that plants receive the water they need with little water wasted. Placement of mulches such as decomposed granite and wood chips throughout the Desert House landscape has many water conserving benefits.

Contact Elaine Anthonise, Desert Botanical Gardens, 480-481-8104 or eanthonise@dbg.org and Jack Mizner, Sandia National Laboratories, 505-845-3576 or jmizne@sandia.gov and go to http://www.dbg.org/center_dl/desert_house_toc.html

From 'Unlikely looking car' page 7

At the workstations, oil filters get recycled into 5-gallon buckets that come from the next-door car wash. Used motor oil is drained to a holding tank, which is periodically pumped out and hauled off to be burned as bunker oil powering ocean-going ships.

Office paper gets used on both sides, then recycled. Salem dumpster dives, sorting stuff that's in the trash into the recycle bins. He has made an income stream of everything except his cardboard, and that bothers him. He's thinking about buying a baler so he can make money on that, too.

Does he use his "green" approach to auto repair to get customers? Negative. But if it doesn't help business, it doesn't hurt. "We don't take any new customers between April and August." Salem told the NNSA visitors. And Salem Boys' rates aren't high, somewhere between the dealerships and the quick-change shops. To pay for all this stuff, Salem adds a 1 percent environmental surcharge to each repair bill—just makes sense, doesn't it?

After numerous architectural awards, environmental awards, and much imitation, including the new local National Guard Armory that takes many of its features from Salem Boys, the owner is practically humble. A lot of what he did, Salem did "to prove the City was wrong," he said. "They wanted me to take three steps and I took 300. I just did things to improve the building." And because it makes sense.

Contact Mark Salem, 480-598-1125 or talk2salem@aol.com and Joe Estey, Prolepsis Training, 360-737-9668 or teaming@aol.com

Boeing in Mesa reduces pollution at the source, maintains military specs



The Boeing Company's Mesa manufacturing facility produces the Apache Longbow attack helicopter. Boeing has reduced its hazardous waste generation by 45 percent over the past 10 years.

The NNSA workshop Source Reduction team toured the Boeing Company in Mesa, Arizona, which produces the Apache AH-64D Apache Longbow attack helicopter and is home to a variety of other military support and technology programs. Boeing in Mesa has a workforce of approximately 5,000 and an annual payroll of \$221 million.

The workshop group's host for the day was Mike Jerman, Manager of Boeing's Safety, Health, and Environmental Affairs (SHEA) Operations. Jerman gave the NNSA visitors an overview of the history of Boeing, their management practices, and their successes as an environmentally friendly company.

Jerman told the Source Reduction team that educating Boeing employees about the importance of eliminating pollution begins with their orientation and continues with shop-specific training in waste reduction methods. Boeing's management conducts weekly shop inspections as well as alternating monthly inspections for safety and environmental concerns.

Boeing's pollution prevention practices include reducing the volume and toxicity of wastes as well as source reduction. The Mesa facility has an active recycling program and relies on treatment and disposal of wastes to the smallest extent possible—the plant has reduced its hazardous waste generation by 45 percent since 1992.

Much of this waste reduction was the result of an overall culture change in the aircraft manufacturing process. Success comes from formal partnerships with the Manufacturing Processes and Standards group, which defines the Mesa site's material specifications and application processes, as well as with Purchasing teammates. Thus pollution prevention at Boeing Mesa begins with using fewer materials that could generate hazardous waste, which drives a program of environmentally preferable purchasing. As orders reach the plant, SHEA's 6-person Hazardous Materials team takes control of all chemicals and dispenses them on an as-needed basis from a central warehouse—if there is a spill while the chemicals are en route, the team is there ready for the cleanup.

Some of Boeing's other efforts to reduce pollution include:

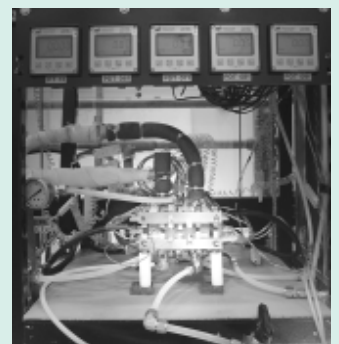
- The FLASHJET™ paint removal system. This system uses a combination of pulsed-light energy and low-velocity carbon dioxide pellets to remove paint from the aircraft's metal and composite surfaces. The process saves preparation time, reduces costs, and retains the aircraft's payload capability. The Source Reduction Team had the opportunity to view this system at work and found it truly impressive.
- Developing paints that contain low amounts of volatile organic compounds in their solvents. Changing to low-VOC paints that still meet mandatory strict military standards reduces air emissions that create ground-level ozone air pollution ("smog").
- Replacing solvent-based vapor-degreasing units with water-based degreasing technology. The new units prevent the release of 30,000 pounds of solvents into the atmosphere annually.
- Using environmentally friendly solvents such as acetone as a degreasing solvent in many areas (EPA recently declared acetone a non-pollutant) and eliminating methylene chloride, a suspected carcinogen, as a solvent.

Contact Mike Jerman, The Boeing Company, 480-891-6384 or michael.d.jerman@boeing.com and Ron Walton, BWXT Y-12, 865-576-8388 or waltonrm@y12.doe.gov

PEMs, MEMS and microvalves optimize fuel cell functions

Research partners at the U.S. Department of Energy's National Energy Technology Laboratory (NETL) and the University of Pittsburgh have designed a piezoelectric microvalve, or PEM, for integration in proton exchange membrane fuel cells. Using microelectrical mechanical systems (MEMS) technology, the fully integrated valve will optimize air and hydrogen flow to help eliminate problems including poor fuel conversion efficiency, hot spots, decreased cell life, and reduced cell voltage. Based on a patent pending flow and energy management concept developed by the NETL Gas Energy Systems Dynamics Focus Area, the system controls cell-to-cell flow distribution inside a fuel cell stack. The University of Pittsburgh is manufacturing the first prototype for testing.

Contact Damon Benedict, NETL, 304-285-4913 or damon.benedict@netl.doe.gov



PEM and Fuel cell on test stand.

At Pacific Northwest, demolition waste disposal goes to the dogs



Nearly 59 metric tons of metals and other materials were recycled or reused from demolition of the 331B Facility Dog Runs at Pacific Northwest National Laboratory.

When the Department of Energy's (DOE) Office of Science (SC) agreed to share the cost with the DOE Office of Environmental Management for demolition of the 331B Facility Dog Runs at the Pacific Northwest National Laboratory (PNNL), it was under the stipulation that the project was not to be carried out as a run-of-the-mill building demolition. SC insisted on cost-effective, innovative ways to reduce the project wastes and costs.

With this in mind, PNNL drew up plans to minimize regulated wastes and optimize reuse and recycling during the Dog Run demolition. Optimizing the diversion of material from disposal to reuse and recycling meant significantly increasing the fraction of material salvaged for reuse/recycle without significantly increasing the cost to the project. Maximizing reuse and recycling could have resulted in 100 percent recovery rates if unlimited funds were available, which they weren't.

The 331B Dog Run and its associated support structures covered approximately 26,000 square feet and housed beagles used in isotopic exposure studies during the Cold War. For such a small facility, a surprising total of nine semi-trailers of material was collected from the project and sent off for reuse or recycle. This included six trailers of scrap metal totaling 86,460 pounds

and three trailers of material and equipment salvaged for reuse (estimated at 43,230 pounds).

Recycling the six loads of scrap metal yielded \$960 for 67,640 pounds of ferrous scrap metal at \$0.0142/lb and \$3,105 for 18,820 pounds of non-ferrous scrap at \$0.165/lb, per PNNL's current contract with Pacific Recycling. The revenue generated from the sale of the other materials salvaged for reuse will not be known until they are auctioned early in 2003.

This wide variety of materials included light fixtures, hose reels, doors, a large operating theater light, a 500-gallon dry animal-feed hopper, chain link fencing, galvanized sheet metal, and a significant amount of galvanized welded metal grating, all turned over to the Tri-City Asset Reutilization Contractor, which will auction the material as part of its contract with DOE to stimulate local economic activity through asset reutilization.

Cost avoidance for choosing recycling/reuse over disposal was calculated using data obtained from Fluor Hanford's "Return on Investment Proposal Preparation Guide." Cost avoidance values contained in the guide do not represent direct cost savings, but rather life-cycle savings that accrue to the entire DOE system when waste disposal is avoided in favor of source reduction, material reuse, or recycling. The total life-cycle cost avoidance for the 129,690 pounds (58.95 metric tons) of material recycled or reused from this project is \$26,351.

Total gross revenue from metal sales plus cost avoidance to DOE as a result of optimizing recycling/reuse during this project was thus \$30,416. The cost to the project to pursue recycling/reuse over disposal was estimated at \$8,000, comprised of approximately 160 additional labor hours at \$50 per hour to disassemble, move, and load the materials for recycle/reuse. Net revenue plus cost avoidance to DOE resulting from the recycle/reuse of material in place of disposal on this project is so far \$22,416.

In addition to optimizing reuse and recycling, demolition project staff worked diligently to segregate regulated materials (asbestos, PCBs, etc.) from non-regulated materials. This team effort was accomplished through the efforts of Fluor Federal Services construction staff and PNNL's Legacy Project staff and Pollution Prevention Team, with assistance from Bechtel Hanford's Pollution Prevention Coordinator Doug Duvon.

Contact Glenn Thornton, PNNL, 509-375-3814 or glenn.thornton@pnl.gov

Labs, universities turn food and farm waste to fuel, chemicals

Two U.S. Department of Energy national labs and a pair of Northwest land grant universities are mobilizing to develop new methods for converting agricultural and food processing residue and wastes into commercially valuable "bio-based" energy and industrial products. Members of the new Northwest Bioproducts Research Institute include Pacific Northwest National Laboratory and Idaho National Engineering and Environmental Laboratory, as well as Washington State University and the University of Idaho. Under terms of the agreement-signed in



July—the participating universities and Federal research laboratories will collaborate to examine and develop methods for converting agricultural and food processing residue and wastes into bio-based fuels and industrial products, such as chemicals for plastics, solvents and fibers. Industry, processors and growers will be able to use and profit from the institute's products and technologies and, in some cases, will profit from the discoveries through licenses.

Contact Greg Koller, PNNL, 509-372-4864 or greg.koller@pnl.gov

Berkeley Lab pushes for delisting of mixed waste treated with new process

Many biomedical, life science, and chemical research organizations regularly use tritium and carbon-14 in their projects, contaminating process solvents with quantities measurable in curies (Ci) of tritium activity or mCi of carbon-14. The hazardous component of this tritiated mixed waste includes Federally listed spent solvents, is designated as high total organic compound ignitable D001 waste, and may contain chloroform (code D022).

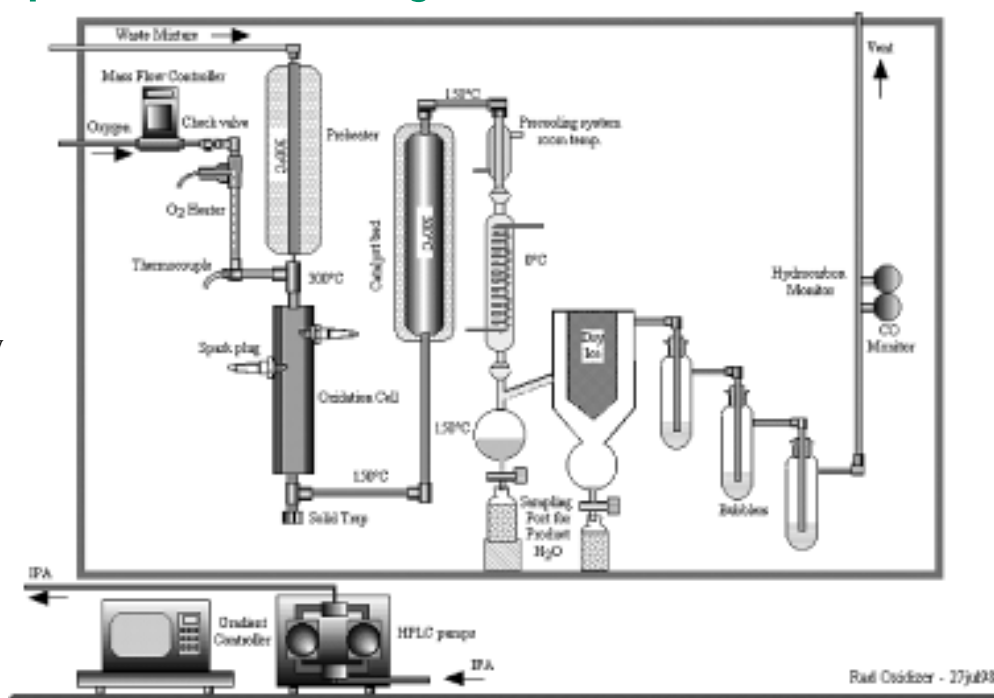
The Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) acknowledge that dual regulation of mixed waste under the Atomic Energy Act and RCRA presents a number of difficulties. For instance, there are very few RCRA disposal sites that also maintain NRC licenses, and the disposal limit for tritium is orders of magnitude below that required for the tritiated mixed waste generated by even a single laboratory.

Currently, the only commercial option for treatment and disposal of tritiated mixed waste is incineration, which has the undesirable environmental impact of tritium release and is expensive—\$15 to \$30 per mCi. The combined legal, environmental, and fiscal issues have forced prolonged storage of tritiated mixed waste at many sites.

Over the past six years, Lawrence Berkeley National Laboratory (LBNL) has developed a technical and administrative approach to deal with tritiated mixed waste. The Berkeley Lab's crowning technical achievement from this intensive research program was the development of a process called catalytic chemical oxidation (CCO), which destroys or removes virtually all of the organic solvents from tritiated mixed waste while confining nearly all of the tritium in the treatment residues. LBNL's administrative success is the result of extensive legal negotiations with the U.S. Environmental Protection Agency and other regulatory agencies to "de-list" the end products of the CCO process—to categorize the treatment residues as low-level radioactive waste.

LBNL's CCO system consists of a preheater (300 deg C), an oxidation cell (500 deg C) with two spark sources, a packed-bed tubular reactor (500 deg C) filled with platinum-coated alumina catalyst, and a recovery and emission reduction system for the oxidation product (tritiated water). The tritiated water recovery system consists of two condensers, a dry-ice cold trap, three water bubblers in series, and a silica gel filter.

When tritiated mixed waste is treated in the CCO system under optimum operating conditions, the destruction and removal



A catalytic chemical oxidation process developed at Lawrence Berkeley National Laboratory has proven to be effective in destroying or removing the hazardous component of mixed waste contaminated with tritium.

efficiency (DRE) of organic solvents exceeds 99.999 percent, while the CCO's condensers, cold trap, water bubblers, and silica gel filter confine more than 99.99 percent of tritium in the treatment residues. These results exceed Federal DRE standards for incineration; the emission of tritium from the CCO process is less than 0.01 percent of that from incineration.

From March 1997 to March 2002, 68 mixed waste samples containing more than 2,300 Ci of tritium activity have been oxidized and

collected from the CCO process, yielding as treatment residues only about 23 liters of tritiated water. This level of performance clearly meets the goals of LBNL's pollution prevention program.

Under RCRA, treatment residues must not exhibit RCRA characteristics, must meet the concentration-based treatment standards for land disposal of F-listed and D-coded components, and must meet the universal treatment standards for underlying hazardous constituents. Also, the high total organic compound designation of tritiated mixed waste means that treatment residues must meet the land disposal restrictions for combustion.

Based on the results of more than 90 oxidation tests using the CCO process, LBNL researchers have demonstrated that the oxidation residues derived from the original listed solvents could be delisted, the liquid products of oxidation could be delisted—on the basis of EPA's Determination of Equivalent Treatment (DET) for the CCO system—and the treatment residues are water or tritiated water only.

After the first three years' research (1997-99), LBNL submitted two petitions to EPA Region IX, asking EPA to approve and concur with the study results and conclusions, so that the oxidized mixed waste treated by the CCO process can be sent offsite as low-level radioactive waste for safe disposal.

Following another three years of persistent administrative efforts by the LBNL researchers, in July EPA issued a proposal to grant LBNL's petitions relating to the treatment of tritiated mixed waste and the CCO process. Although the EPA proposal is targeted to LBNL research, it has the potential to be generically applied.

In the proposal, published in the *Federal Register*, Wed. July 31, 2002, EPA determined that "the petitioned waste is essentially tritiated water with no detectable organic chemical constituents, and . . . is nonhazardous with respect to the original listing criteria." Furthermore, "LBNL has adequately

demonstrated that the CCO technology is equivalent to combustion for the treatment of organic wastes.” EPA proposes to grant LBNL an exclusion and a DET for the CCO treatment residues.

If the proposal becomes final, EPA’s approval of the CCO process will serve as a precedent for generators of tritiated mixed waste



Lawrence Berkeley research scientist Li-Yang Chang appeals to participants in the November NNSA pollution prevention workshop for their support in finalizing EPA approval of the CCO process.

throughout the U.S. Widespread endorsement of EPA’s position will help implementation of this pollution prevention approach at other research facilities.

But EPA’s ruling is not yet final. Li-Yang Chang and fellow LBNL researcher Philip Williams, the CCO project’s principal investigators, have appealed to scientists and technicians throughout the Department of Energy complex and beyond for help. Chang, addressing the recent National Nuclear Security Administration pollution prevention workshop in Phoenix, said, “We need your strong support as individuals in order to get this proposed rule finalized.”

Chang and Williams ask that you send your comments to:

Rich Vaille
Waste Management Division (WST-1)
EPA Region IX
75 Hawthorn Street
San Francisco, CA 94105

To facilitate your support, a sample letter is available at <http://home.pacbell.net/pgwillia/delisting/index.html>

Contact Li-Yang Chang, 510-486-4843 or LYChang@lbl.gov and Philip Williams, 510-486-7336 or PGWilliams@lbl.gov

‘Goop’ developed for new dishwasher E2 regulations

A high-tech generation of dishwashers that use microprocessors to judge the amount of residue on dishes—and adjust the washing cycle accordingly—is already in stores and the Federal government is taking a new interest in your dirty dishes.

According to Scripps Howard News Service, the U.S. Department of Energy (DOE) is studying how dirty the dishes are that Americans put in their dishwashers. The information will be used to develop new regulations on the energy efficiency of dishwashers.

Consultants hired by DOE estimate that 62 percent of American households do some pre-cleaning of their dishes before loading the washer. About a third scrape their plates a little but about 5 percent of Americans simply dump completely filthy dishes in their dishwashers. In a related area of focus, the experts determined that about 20 percent of Americans run the dishwasher when it’s half empty, but 80 percent wait until it’s full, which allows debris on dishes to harden and makes it more difficult to remove. The study also found that as much as a third of the dishes Americans are putting in their dishwashers these days are plastic, rather than the traditional ceramic and glass used in the Energy Department’s testing program.

The industry also has developed a “goop” composed of several different types of messy foods to study dishwashing worst-case scenarios. Sloppy as this substance was, the consultants informed DOE that even the goop didn’t accurately depict American dishwasher use.

Current regulations devised more than 20 years ago used already-cleaned dishes to determine the energy efficiency of dishwashers. New regulations may be put off until 2003 after additional studies on the dirtiness of dishes in average American homes.



Shaw Environmental, Inc., a contractor to the U.S. Department of Energy’s Nevada Operations Office, is taking the P2 issue seriously. In November, Shaw handed out new coffee mugs to all employees at its Las Vegas division to encourage them to quit using Styrofoam™ coffee cups. “We personalized each with their names, using paint pens that won’t wash off, and made it a fun event by

enlisting several ‘artists’ within our company,” said Shaw’s Terri Baker. “We set up in the kitchen, and personalized the cups over the lunch hour. The artists dressed up in berets and we had Parisian music playing in the background to get everyone in the mood. We made pop art posters and have hung them throughout our building, encouraging employees to ‘reuse for the next cup.’”

Contact Terri Baker, 702-295-0928 or terri.baker@shawgrp.com

A word of farewell from DOE P2 Champion John Marchetti



Since 1988, the Department of Energy has made great strides in preventing pollution. This has not been easy, because every day another barrier rises from the ashes. Everywhere you turn, there's a "naysayer" prepared to slam a door in your face. Yet, through all this adversity, including a lack of commitment from management, I have always been amazed to see how the Department manages, unwillingly, to develop more and more Environmental Stewards.

Environmental Stewards such as those I have met and known throughout these last 14 years continue striving to sustain natural resources and our environment for future generations. Whether it's pollution prevention, environmental management systems, sustainable development, or any other positive environmental initiative, we need to continue our efforts to make everyone aware and sensitive to the frailty of the environment that surrounds our workplace. I could reel off the names of everyone in our pollution prevention family, but you folks know who you are—the Bills, Beths, Arnies, Toms, Marjories, Jans, Evas, Rons, Karins, Cynthias, Mikes, Johns, Als, Glenns, Jims, Kennys, Jacks, Kristens, Barbaras, Shelleys, Lauras, Sallys, Chrises, Kevins, Susans, Dans, and many others.

God blessed me when I was handed the assignment of implementing waste minimization/pollution prevention throughout the nuclear weapons complex. Because otherwise, I would have never met some of the finest, most conscientious, dedicated people in the Department of Energy.

Continue fighting the battle. Remember, you are the environmental conscience of the Department of Energy. Set aggressive environmental performance goals for yourselves; make a commitment to help your facility to exceed compliance; maintain a functional EMS; mentor others on pollution prevention principles; network with other pollution prevention coordinators within the Department; and demonstrate to management how pollution prevention, EMS, and sustainable development can and must be integrated into core mission functions.

Don't forget me. . . you people are my family. You will always have a place in my heart.

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